

Nature Over Nurture: Temperament, Personality, and Life Span Development

Robert R. McCrae and Paul T. Costa, Jr.
National Institute on Aging

Fritz Ostendorf and Alois Angleitner
Universität Bielefeld

Martina Hřebíčková
Academy of Sciences of the Czech Republic

Maria D. Avia, Jesús Sanz, and
Maria L. Sánchez-Bernardos
Universidad Complutense de Madrid

M. Ersin Kusdil, Ruth Woodfield, Peter R. Saunders, and Peter B. Smith
University of Sussex

Temperaments are often regarded as biologically based psychological tendencies with intrinsic paths of development. It is argued that this definition applies to the personality traits of the five-factor model. Evidence for the endogenous nature of traits is summarized from studies of behavior genetics, parent-child relations, personality structure, animal personality, and the longitudinal stability of individual differences. New evidence for intrinsic maturation is offered from analyses of NEO Five-Factor Inventory scores for men and women age 14 and over in German, British, Spanish, Czech, and Turkish samples ($N = 5,085$). These data support strong conceptual links to child temperament despite modest empirical associations. The intrinsic maturation of personality is complemented by the culturally conditioned development of characteristic adaptations that express personality; interventions in human development are best addressed to these.

There are both empirical and conceptual links between child temperaments and adult personality traits. The empirical associations are modest, but the conceptual relations are profound. Explaining how this is so requires a complicated chain of arguments and evidence. For example, we report cross-sectional data showing (among other things) that adolescents are lower in Conscientiousness than are middle-aged and older adults in Germany, the United Kingdom, Spain, the Czech Republic, and Turkey. The relevance of such data may not be immediately obvious, but in fact they speak to the transcontextual nature of personality traits and thus to the fundamental issue of nature versus nurture.

The gist of our argument is easily stated: Personality traits, like temperaments, are endogenous dispositions that follow intrinsic paths of development essentially independent of environmental influences. That idea is simple, but it is so foreign to the thinking of most psychologists that it requires a detailed exposition and defense. Once grasped, however, it offers a new and fruitful perspective on personality and its development.

A Theoretical Perspective on Temperament

There is no hard and fast distinction between temperament and personality. *The American Heritage Dictionary of the English Language* defines *temperament* as “the manner of thinking, behaving, or reacting characteristic of a specific individual” (Morris, 1976, p. 1324), a definition which might serve equally well for *personality trait*. One of the first omnibus personality inventories, measuring such traits as ascendance, emotional stability, and thoughtfulness, was designated by J. P. Guilford and his colleagues (Guilford, Zimmerman, & Guilford, 1976) as a “temperament survey.” In some respects, then, there is a long tradition of equating these two sets of individual differences variables.

There is also a long tradition of distinguishing them. Temperament is frequently regarded as a constitutional predisposition, observable in preverbal infants and animals, and tied, at least theoretically, to basic psychological processes. Personality traits, in contrast, are often assumed to be acquired patterns of thought and behavior that might be found only in organisms with sophisticated cognitive systems. Constructs like authoritarianism, self-

Robert R. McCrae and Paul T. Costa, Jr., Personality, Stress, and Coping Section, Gerontology Research Center, National Institute on Aging, National Institutes of Health; Fritz Ostendorf and Alois Angleitner, Department of Psychology, Universität Bielefeld, Bielefeld, Germany; Martina Hřebíčková, Institute of Psychology, Academy of Sciences of the Czech Republic, Brno, Czech Republic; Maria D. Avia, Jesús Sanz, and Maria L. Sánchez-Bernardos, Department of Psychology, Universidad Complutense de Madrid, Madrid, Spain; M. Ersin Kusdil, Ruth Woodfield, Peter R. Saunders, and Peter B. Smith, School of Social Sciences, University of Sussex, Sussex, England.

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Correspondence concerning this article should be addressed to Robert R. McCrae, Box 3, National Institute on Aging Gerontology Research Center, 5600 Nathan Shock Drive, Baltimore, Maryland 21224-6825. Electronic mail may be sent to jeffm@mxg.gre.nia.nih.gov.

monitoring, and narcissism do not appear to be directly applicable to chimpanzees or human infants.

Some theorists divide personality traits into two categories, corresponding to innate and acquired characteristics. For example, Cloninger and his colleagues (Cloninger, Przybeck, Svrakic, & Wetzel, 1994) classified Novelty Seeking, Harm Avoidance, Reward Dependence, and Persistence as temperaments, and Self-Directedness, Cooperativeness, and Self-Transcendence as aspects of character. Other theorists assume that temperament provides the starting place for personality development, a tabula that is not quite *rasa*. All those personality theorists who nod to "constitutional factors" (e.g., Kluckhohn & Murray, 1953) adopt some such position. An appealing version of this constitutional perspective would distinguish between broad factors, like Extraversion, that might correspond to basic temperamental influences, and specific traits, like sociability or dominance, that might be interpreted as acquired personality traits.

There is, however, a completely different way to conceptualize these important distinctions. McAdams (1996) has offered a formulation of the personality system as a whole in terms of three levels. Personality traits are assigned to Level 1 in McAdams's scheme, whereas "constructs that are contextualized in time, place or role" (p. 301), such as coping strategies, skills, and values, occupy Level 2. (Level 3 includes life narratives that give unity and purpose to the self.) A related system has been proposed by McCrae and Costa (1996, 1999) in a five-factor theory (FFT) of personality. As shown schematically in Figure 1, the FFT highlights the distinction between biologically based *basic tendencies*

and culturally conditioned *characteristic adaptations* (which include the important subcategory of self-concepts). Basic tendencies comprise abstract potentials and dispositions (including the traits in McAdams's Level 1), whereas characteristic adaptations include acquired skills, habits, beliefs, roles, and relationships (constructs from McAdams's Level 2).

In the terminology of FFT, Cloninger and colleagues (Cloninger et al., 1994) would presumably place Novelty Seeking and Harm Avoidance in the category of basic tendencies, and Self-Directedness and Cooperativeness in the category of characteristic adaptations. The alternative, constitutional view would perhaps hold that the temperamental basis of personality—including the five factors listed in Figure 1—is a part of basic tendencies, whereas personality traits like sociability and dominance are characteristic adaptations.

According to FFT, however, both broad personality factors and the specific traits that define them are best understood not as characteristic adaptations, but rather as endogenous basic tendencies. FFT has returned, as it were, to Guilford's (Guilford et al., 1976) view that the attributes measured by personality questionnaires can be identified as temperaments (Costa & McCrae, in press).

Some readers will be surprised by the claim that the whole range of personality traits can be subsumed by temperament. In support of that claim, most of the findings summarized in this article are taken from research on the five-factor model of personality, which is intended to provide a comprehensive taxonomy of traits (Goldberg, 1993). It should be noted, however, that the basic ideas are

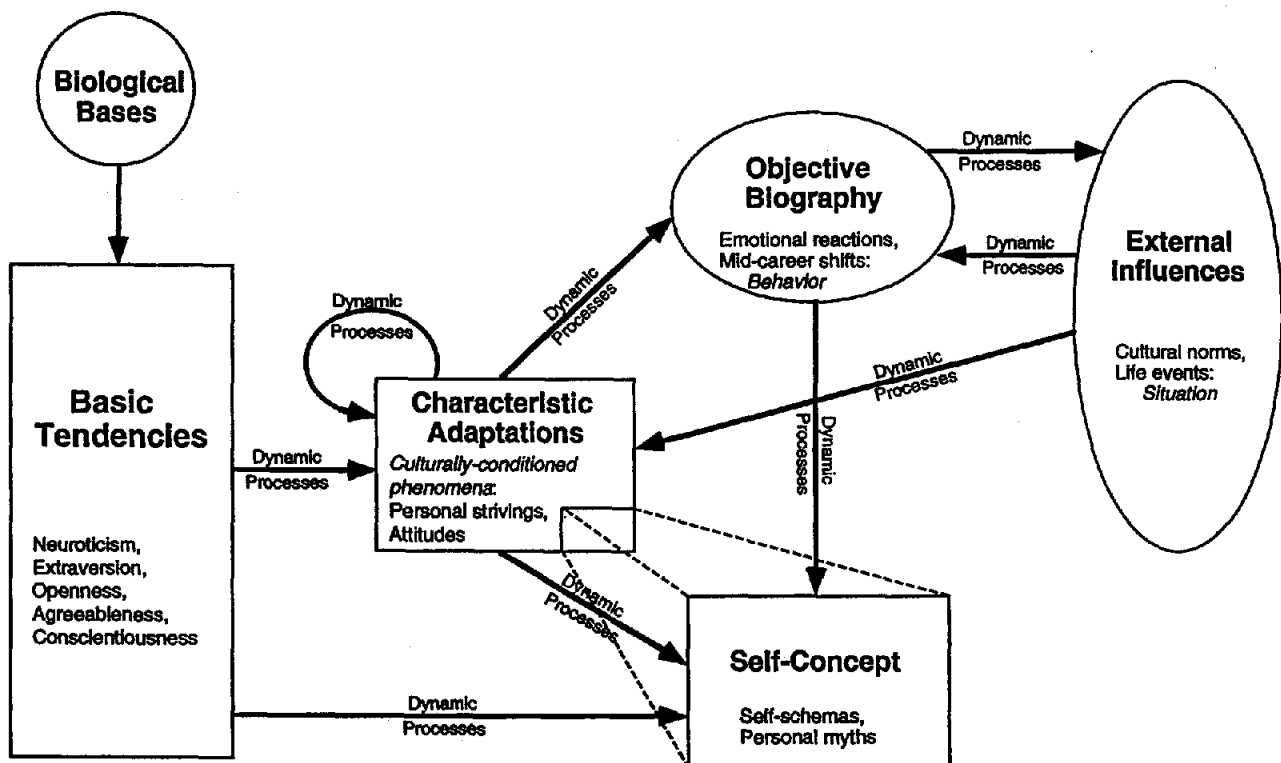


Figure 1. A model of the personality system according to five-factor theory, with examples of specific content in each category and arrows indicating paths of causal influence. Adapted from "A Five-Factor Theory of Personality," by R. R. McCrae and P. T. Costa, Jr., 1999, in *Handbook of Personality* (2nd ed., p. 142), edited by L. Pervin and O. P. John, New York: Guilford Press.

likely to be applicable to many alternative models as well. For example, there is evidence of cross-cultural invariance for three- and seven-factor models (Benet-Martínez & Waller, 1997; S. B. G. Eysenck, 1983), and the pattern of adult age differences reported here can also be seen in California Psychological Inventory scales (Gough, 1987; Labouvie-Vief, Diehl, Tarnowski, & Shen, in press; Yang, McCrae, & Costa, 1998).

Most readers will probably be startled by the conspicuous absence in Figure 1 of an arrow from *external influences* to *basic tendencies*. This is not an oversight; FFT deliberately asserts that personality traits are endogenous dispositions, influenced not at all by the environment. That assertion is, of course, an oversimplification, but we believe it is a heuristically valuable one and a useful corrective to what Asendorpf and Wilpers (1998) recently called "the naive environmentalism that has for a long time dominated the literature on personality development" (p. 1543). In this article we hope to show that FFT provides a useful framework for understanding child temperament and adult personality development.

The Roles of the Environment

First, however, we must reassure the reader that environmental influences play crucial roles in the functioning of the personality system in several different respects: They define the conditions under which human personality evolved; they shape a vast array of skills, values, attitudes, and identities; they provide the concrete forms in which personality traits are expressed; and they supply the trait indicators from which personality traits are inferred and trait levels are assessed.

At one level, all psychological characteristics must be understood as end results of evolutionary processes by which organisms have adapted to their environment (D. M. Buss, 1991). Evolutionary principles are most easily applied to explain characteristics that distinguish different species, and their application to the explanation of individual differences within species is controversial (D. M. Buss & Greiling, 1999). Indeed, Tooby and Cosmides (1990) argued that differences among human beings in personality traits are best regarded as noise of no evolutionary significance. At a minimum, however, that implies that personality variations are compatible with the usual human environment: We know from their continued presence among us that both introverts and extraverts can survive in the human world.

The environment also operates at a much more direct level. A recent book on the limited influences of parenting (Harris, 1998) was greeted with alarm by many psychologists, who interpreted it to imply that the way parents treat their children does not matter (Begley, 1998). In contrast, FFT explicitly recognizes that

The influence of parents on their children is surely incalculable: they nourish and protect them, teach them to walk and talk, instill habits, aversions, and values, and provide some of the earliest models for social interaction and emotional regulation (McCrae & Costa, 1994, p. 107).

In short, parenting has important long-term consequences for the development of characteristic adaptations, including, of course, the lifelong relationship between parent and child. Many other aspects of the environment are also significant influences on characteristic adaptations, including peers (Harris, 1998), the media, educational

systems, and so on. Vocational interests, religious beliefs, food preferences, tactics of interpersonal manipulation, and group loyalties are some of the products of these influences, and it is possible to view and study psychological development as the creation and integration of these characteristic adaptations. This approach may be particularly appealing in collectivistic cultures, in which the individual's evolving place in social networks is of more concern than are autonomous features of the individual (Kagitçibaşı, 1996). But important as this form of development may be, FFT asserts that it is not what personality psychologists get at when they administer personality questionnaires to assess such characteristics as assertiveness, curiosity, or shyness.

However, the environment also has a direct relation to personality traits, because characteristic adaptations are always involved in their expression. To take a simple example, interpersonal traits are most often inferred from communication with others, and that normally requires a common acquired language such as English, Shona, or Hindi. At what is perhaps a more psychologically meaningful level, trait manifestations must fit within a cultural context. An expression of sympathy for the deceased could be insulting in a culture in which the dead are never mentioned by name; thus, an agreeable person must learn how to be polite in terms of the culture's rules of etiquette. Even apparently direct manifestations of personality, such as the chronic anxiety of an individual high in Neuroticism, are usually contextualized: Anxious Americans worry about computer viruses and the future of Social Security; anxious Navahos—at least when they were studied by Clyde Kluckhohn (1944)—worried about ghosts and witches (cf. Kitayama & Markus, 1994).

According to FFT, traits cannot be directly observed, but rather must be inferred from patterns of behavior and experience that are known to be valid trait indicators (Tellegen, 1988). Personality scales rely on these indicators and need to be sensitive to variations introduced by culture, age, and other contexts. But although they may ask respondents about their values, habits, or concerns, personality inventories are designed to allow the inference of deeper psychological constructs.

Personality Traits as Endogenous Basic Tendencies

If the environment has such obvious and pervasive effects on characteristic adaptations and the expression of personality traits, why not presume that it also affects traits themselves? According to FFT, personality is biologically based, but it is well established that perceptual and learning experiences can reshape the developing brain (Kolb & Whishaw, 1998), and recent studies suggest that traumatic stress may contribute to atrophy in the hippocampus (Bremner, 1998). Thus, life experience might affect personality through its effects on the brain (Nelson, 1999). There is cross-sectional evidence that the experience of acculturation can change personality profiles (McCrae, Yik, Trapnell, Bond, & Paulhus, 1998), and some longitudinal research has shown that personality change is associated with life events (Agronick & Duncan, 1998).

All of these findings are useful reminders that the theoretical generalizations represented in Figure 1 certainly have exceptions. However, the generalization that personality traits are more or less immune to environmental influences is supported by multiple, converging lines of empirical evidence that significant variations in life experience have little or no effect on measured personality

traits. Any one of these lines of evidence is subject to many alternative interpretations, but taken together, they make a strong case for regarding personality traits as fundamentally temperament-like. That assumption makes sense of many findings that would remain puzzling from the perspective of naive environmentalism. In the following section, we review some research consistent with this premise of FFT.

Heritability of personality. The study of behavior genetics has flourished in the past 20 years, and the results of many twin and adoption studies have shown remarkable unanimity (Loehlin, 1992): Personality traits have a substantial genetic component, little or no component that can be attributed to shared environmental effects (e.g., attending the same school or having the same parents), and a residual component about which little is yet known. Heritability is virtually a sine qua non of biologically based theories of personality, so it is crucial to note that it is not limited to Neuroticism and Extraversion, which are often conceded to be temperamental traits (H. J. Eysenck, 1990). All five factors are heritable; in fact, some estimates find the strongest evidence of heritability for Openness to Experience (Loehlin, 1992).

Further, people inherit more than the global dispositions summarized by the five major personality factors; specific traits such as self-consciousness, gregariousness, and openness to ideas are also specifically heritable (Jang, McCrae, Angleitner, Riemann, & Livesley, 1998), and in this regard can better be considered basic tendencies than characteristic adaptations.

But behavior-genetic studies also speak to the importance of environmental effects, although what they say is subject to different interpretations. The sheer weight of evidence has by now convinced most psychologists familiar with that literature that environmental influences shared by children in the same family have little or no effect on adult personality (Plomin & Daniels, 1987). If the environment is to have any effect, it must be through what is typically labeled the *nonshared environment*, the set of experiences unique to different children in the same family (e.g., having different first-grade teachers or being a parent's favorite). However, this term is not measured directly, but rather it is calculated as a residual, and as such it includes far more than experience; in particular, it includes both random error of measurement and systematic method bias. When Riemann, Angleitner, and Strelau (1997) reduced method variance by combining self-reports and observer ratings from two peers, their heritability estimates for the five factors, ranging from .66 to .79, were considerably higher than the .50 usually cited. The remaining 21% to 34% of the variance might include nonshared influences from the psychological environment, such as peer groups, but it might instead reflect wholly biological sources, such as the prenatal hormonal environment (Resnick, Gottesman, & McGue, 1993), minor brain damage or infection, or simply the imperfect operation of genetic mechanisms. Behavior-genetic studies still allow for the possibility of some kinds of environmental influences on traits, but they do not as yet offer a compelling reason to modify Figure 1.

Studies of parental influences. Behavior-genetic designs infer effects indirectly from the phenotypic similarity of people with different kinds and degrees of relatedness; they do not directly measure any putative cause of personality traits. There are, however, studies that have linked child-rearing behaviors or parent-child relations to adult personality traits (e.g., Rapee, 1997). Most

of these studies were retrospective, and many found some association. McCrae and Costa (1988), for example, previously reported that men and women who recalled their parents as being especially loving described themselves as being better adjusted and more agreeable. Although this appears to provide direct support for parental influences on personality, there are many alternative interpretations. Perhaps parents had been more loving because these adjusted and agreeable children had been more lovable. Perhaps the same genes that made the parents loving made the children adjusted. Perhaps retrospective bias made kind children recall their childhood with exaggerated fondness. Despite the possible operation of all these artifacts, the observed correlations were only in the range from .10 to .30, accounting for at most 10% of the variance in adult personality traits (cf. Rapee, 1997).

It is possible that the effects of parenting are more focused, affecting specific personality traits rather than broad factors. But when the 30 facet scales of the Revised NEO Personality Inventory (NEO-PI-R; Costa & McCrae, 1992a) were correlated with Loving/Rejecting, Casual/Demanding, and Attention scales for father and for mother, none of the 180 correlations reached .30 ($Mdn |r| = .08$; McCrae & Costa, 1994).

The results of the rare prospective-longitudinal studies are more informative. In one of the first and best of these, Kagan and Moss (1962) examined maternal characteristics during three age periods from infancy to age 10 and assessed the child's personality at ages 19–29. Of 552 relevant correlations, only 35 (6%) reached statistical significance at the $p < .05$ level. If parenting has an effect on personality, it is subtle indeed (Harris, 1998).

All these findings are consistent with the results of adoption studies (e.g., Plomin, Corley, Caspi, Fulker, & DeFries, 1998), which showed that children bear little resemblance to either their adoptive parents or their adoptive siblings. Neither parental role modeling nor the parenting practices that would affect all children in a family seem to have much influence on personality traits.

Cross-cultural studies of personality structure. It is possible that environmental influences relevant to personality development lie outside the family, in the broader institutions that are collectively called *culture*. As a biologically based phenomenon common to the human species, the fundamental structure of infant and child temperament ought to transcend culture, and there is some evidence that it does (Ahadi, Rothbart, & Ye, 1993). But over time, many psychologists would find it reasonable to argue that the pervasive forces of culture can arbitrarily redefine the parameters of personality—indeed, that was a central premise of the school of culture and personality that flourished in the first half of this century (Singer, 1961). Some contemporary social scientists still find this a plausible argument. Junji (1996) challenged the idea that the five-factor model would apply cross-culturally: “Different cultures and different languages should give rise to other models that have little chance of being five in number nor of having any of the factors resemble those . . . of middle-class Americans” (p. 864).

However, studies using the Personality Research Form (Pauonen, Jackson, Trzebinski, & Forsterling, 1992; Stumpf, 1993) and the NEO-PI-R (e.g., Martin et al., 1997; McCrae & Costa, 1997; McCrae, Costa, del Pilar, Rolland, & Parker, 1998) have reported clear and detailed replication of the five-factor model in cultures ranging from Malaysia to Estonia. The traits that define the five factors in American samples define the same factors around the world. In this respect, the structure of individual dif-

ferences appears to be a universal feature of human groups, relatively impervious to cultural variation.

Some authors have argued that there are additional personality factors, such as Chinese Tradition (Cheung et al., 1996) and (Filipino) Temperamentalness (Church, Katigbak, & Reyes, 1998) that are indigenous to specific cultures. Such culture-based factors would constitute evidence against a purely endogenous theory of the origins of personality. As yet, however, we know too little about indigenous factors to understand how to evaluate this evidence. Perhaps they are measurement artifacts or social attitudes that should be distinguished from personality traits per se; perhaps they really are universal factors that have so far gone unnoticed in other cultures. Because of their importance in the nature–nurture controversy, such proposed factors merit intensive longitudinal, cross-observer, and behavior–genetic research.

Comparative studies. The five-factor model may be found in every culture because it is a product of human biology; recent research on animals suggests that at least some of the five factors may also be shared by nonhuman species. Gosling and John (1998) asked cat and dog owners to describe their pets, with terms taken from the five-factor model or from a list intended to describe temperament in animals. In both instruments and in both species, they found four factors: three corresponding to Neuroticism, Extraversion, and Agreeableness, and the fourth combining features of Openness to Experience and Conscientiousness in a kind of animal Intellect factor. King and Figueredo (1997) analyzed zookeeper ratings of chimpanzees and found six factors, which corresponded to the five-factor model plus a large dominance factor.

It has been known for many years that the five-factor structure of personality can be approximated even in ratings of strangers (Passini & Norman, 1966), so it might be suspected that these ratings of animals were merely projections of implicit personality theory. But Gosling and John (1998) could not replicate a five-factor structure of personality in cats or dogs, even when they used Procrustes rotation, suggesting that something other than sheer implicit personality theory was at work. King and Figueredo (1997) demonstrated substantial agreement between observers on chimpanzee personality ratings—the same kind of evidence that Norman and Goldberg (1966) had used to rebut the claim that personality ratings of humans were mere cognitive fictions.

The use of personality ratings in the description of nonhuman species may seem odd—is it meaningful to assess a dog's efficiency, harshness, or creativity?—but there is by now substantial scientific literature on the topic (A. H. Buss, 1997; Gosling, 1998). It seems much less odd to speak about temperament in animals; if traits are temperaments, then the literature on individual differences in animals can be more easily understood.

Temporal stability of adult personality. Beginning in the 1970s, several independent longitudinal studies (e.g., Block, 1981; Siegler, George, & Okun, 1979) began to address the stability of individual differences in personality traits. Results, with researchers using a variety of samples, instruments, and methods of measurement, showed a consistent pattern of stability. Retest correlations over 6, 12, or 20 years were not much smaller than short-term retest reliabilities; personality in 70-year-olds could be predicted with remarkable accuracy from assessments made 30 years earlier (Costa & McCrae, 1992b; Finn, 1986).

On the one hand, these findings pointed to the existence of something in the individual that endured over long periods of time—a key piece of evidence for the reality of personality traits. On the other hand, it cast into doubt the influence of intervening events. Over the course of a 30-year study, many participants would have had major life changes in occupation, marital status, family stage, physical health, and place of residence. They would have shared their cohort's experience of assassinations, wars, and recessions; read dozens of books; watched thousands of hours of television. But the cumulative force of all these external influences on personality test scores is barely detectable.

Again, it is possible that life events and experiences affect some specific traits even if they do not have a major impact on broad factors. However, in a study of 2,274 men and women traced from about age 40 to age 50, retest correlations for the 30 eight-item NEO-PI-R facet scales were uniformly high, ranging from .64 for Vulnerability to .80 for Assertiveness and Openness to Aesthetics (Siegler & Costa, 1999).

The Intrinsic Maturation of Personality

Studies of heritability, limited parental influence, structural invariance across cultures and species, and temporal stability all point to the notion that personality traits are more expressions of human biology than products of life experience. Another more recent line of evidence concerns maturation and personality change. Here we present the latest findings from a series of studies that have examined age differences in the mean levels of personality traits across cultures. The basic argument is straightforward: If personality development reflects environmental influences, then groups whose histories have led them through different environments should show different developmental outcomes. Conversely, if personality development proceeds independently of life experiences, then similar trends should be seen everywhere.

The data reviewed above on the temporal stability of personality traits were retest correlations that reflect the consistency of rank order across two occasions. High stability of individual differences does not mean that personality trait scores are unchanging, only that people retain their relative standing across any changes that occur. If the trait score of every individual in a sample increased by exactly the same amount over an interval, the retest correlation would be 1.0, no matter how large or small the increase. The personality changes of interest here must be examined by comparing mean levels.

Initial work in studies of adults conducted in the United States found very modest mean level effects after age 30. For example, in a large and representative sample of men and women between ages 35 and 84, the correlations of age with Neuroticism, Extraversion, and Openness to Experience were $-.12$, $-.16$, and $-.19$, respectively (Costa et al., 1986). Later comparisons of college students with older adults showed larger effects, albeit in the same direction: Students scored about one-half standard deviation higher than adults on Neuroticism, Extraversion, and Openness to Experience (Costa & McCrae, 1994). They also scored consistently lower than adults on Agreeableness and Conscientiousness.

In themselves, these data are powerfully ambiguous. Perhaps they represent the effects of intrinsic maturation, but there are many other possibilities as well. This pattern of maturation may be purely American, a response to an educational and economic

system that encourages an extended adolescence. Or it may reflect cohort differences, the effects of coming of age at specific times in history. Perhaps present-day adolescents are less conscientious than their grandparents are because they have grown up in an era of affluence, or of easily available drugs, or of rock music.

The usual suggestion for a research design to help untangle such confounds is the longitudinal study. Because comparisons are made between the same individuals tested on two (or more) occasions, birth cohort effects are controlled in longitudinal designs. If increases in Conscientiousness were documented in a group of college students as they grew into middle adulthood, that would provide more direct evidence of a true maturational effect. In fact, some studies have reported just such longitudinal changes in variables related to Conscientiousness (Jessor, 1983; McGue, Bacon, & Lykken, 1993).

Longitudinal studies take time to conduct, however, and longitudinal studies of Americans tell us nothing directly about age changes in different cultural and historical contexts. Cross-sectional studies of age differences conducted in other cultures, however, provide a simple way to circumvent some limitations of both cohort and culture, because different cultures have usually had differing recent histories.

Consider Turkey and the Czech Republic. Turkey is an Islamic country, and its citizens speak an Altaic language. Following the disintegration of the Ottoman Empire at the end of World War I, a new and radically secular society was established, modeled on the West. Institutions from the alphabet to style of dress were reformed; most significantly, women were given unprecedented opportunities for education and occupations outside the home. Turkey was not directly involved in World War II and has progressed slowly toward multiparty democracy. Throughout the century it has grown in prosperity and urbanization, with a concomitant decline in strong kinship systems.

The Czech Republic, a traditionally Christian nation whose citizens speak a language from the Slavic branch of the Indo-European family, began the century as part of the Austro-Hungarian Empire. Between world wars it functioned as a democracy with a highly industrialized economy. In 1938, Germany began an occupation of Czechoslovakia that was ended by Soviet troops in 1945; Soviet dominance continued thereafter, with nationalization of industry and collectivization of agriculture. Attempted reform in 1968 led to a military response from the Warsaw Pact, and political repression continued until the collapse of Communist control in 1989.

The life experiences of Turks and Czechs have thus been radically different in this century, and both have differed from those of Americans. If experiences shape personality, then cohorts born at the same time in these three countries would presumably differ in mean levels. Czech adolescents, for example, who have spent much of their lives in a democratic society, might be better adjusted than their politically traumatized parents and grandparents. In contrast, American adolescents are known to be higher in Neuroticism than their parents' generation (Costa & McCrae, 1994).

Two previous studies have compared age differences on NEO-PI-R scale scores across cultures (Costa et al., in press; McCrae et al., 1999). In each, data were standardized within culture (to eliminate translation effects) and means were calculated for the age groups of 18–21, 22–29, 30–49, and 50+. Data were avail-

able for secondary analysis from Germany, Italy, Portugal, Croatia, South Korea, Russia, Estonia, and Japan. In four of the cultures (Italy, Croatia, Russia, and Estonia), there were no significant age effects for Neuroticism. In the other four cultures, Neuroticism was higher in younger respondents—just as it had been in American studies. Results for the remaining factors are easily summarized: In every culture, the American pattern was replicated. Extraversion and Openness to Experience declined and Agreeableness and Conscientiousness increased with age in Germany, Italy, Portugal, Croatia, South Korea, Russia, Estonia, and Japan.

Xiu, Wu, Wu, and Shui (1996) examined age differences on a Chinese version of the short form of the NEO-PI-R, the NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1992a). In a sample of 593 men and women between ages 20 and 84, small but significant age effects were found for Neuroticism and Openness to Experience, which declined with age, and Agreeableness, which increased with age. Thus, this study offers a partial replication of American effects (see also Yang, McCrae, & Costa, 1998).

New Data From Five Cultures

In this article we report analyses of the NEO-FFI administered in Germany, the United Kingdom, Spain, the Czech Republic, and Turkey. The American version was adapted for use in the U.K., and translations were made into the other languages and checked by review of a back-translation. Internal consistency for the five 12-item scales ranged from .48 (for Agreeableness in the Turkish sample) to .85, with a median of .76; in every sample, internal consistency was lowest for the Agreeableness and Openness to Experience scales, suggesting that results with these two scales should be viewed with some caution.

Previous cross-cultural studies using the NEO-PI-R have examined only adult development, in part because American normative data have been published only for college-age and older adults. The present article includes data from adolescents between ages 14 and 17 from four of the samples. The NEO-FFI has demonstrated validity when used in samples of intellectually gifted American sixth graders (Parker & Stumpf, 1998); internal consistencies in the four adolescent subsamples studied here ranged from .57 to .86, with a median of .75, values which are comparable to those seen in adults.

Data were originally collected for a variety of purposes, and as Table 1 shows, the distribution by age group is not optimal in several instances. Nevertheless, there appear to be sufficient cases in most age groups to make secondary analyses worthwhile. The German sample consists of mono- and dizygotic twins, on whom both self-reports and mean peer ratings of personality are available (Riemann et al., 1997). These respondents are part of a large German sample whose full NEO-PI-R scale scores were previously analyzed (McCrae et al., 1999). They are included here not as an independent replication, but rather as a check on the consistency of results from the long and short versions of the NEO-PI-R.

Data from the U.K. were obtained in three studies that involved adolescent school children, their parents, and university students. An effort was made to include respondents from all occupational groups; most respondents were from the southern part of the U.K. The Turkish sample consisted of adolescents from many regions in Turkey that attended a summer camp, and families in the city of

Table 1
Composition of the Samples by Age Group and Gender

Sample	Age group (in years)									
	14-17		18-21		22-29		30-49		50+	
	M	W	M	W	M	W	M	W	M	W
German	42	149	85	252	215	515	182	615	73	230
British	41	39	135	135	28	29	40	72	12	9
Spanish			49	74	145	116	117	143	67	53
Czech	147	263	117	116	26	25	78	76	40	24
Turkish	157	112	16	7			84	108	21	6

Note. None of the Spanish respondents was under 18 years old; none of the Turkish students or their parents was between ages 22 and 29. M = men; W = women.

Bursa, a major industrial center. The Spanish and Czech samples were both recruited by undergraduate psychology students who invited friends, relatives, and partners to join the study. None of these samples is either random or nationally representative, but it seems unlikely that they share any systematic sampling bias that might explain common age trends.

As in previous studies, *T* scores were computed within each culture using means and standard deviations from the adults over age 21 (following the American convention). The only meaningful comparisons are thus among age groups within each culture. Analyses of variance (ANOVAs) with age group and gender as classifying variables showed generally similar patterns in men and women: Of the 25 ANOVAs, only 5 showed significant interaction terms, with no pattern replicated across cultures. Four of the

interactions were quite small, accounting for less than 2% of the variance. A somewhat larger effect was seen for Openness to Experience in the Turkish sample, in which age differences were found only in women.

Results for the total sample are summarized in Figures 2-6. The ANOVAs confirm that there are significant cross-sectional declines in Neuroticism and Extraversion and increases in Conscientiousness in all five samples. There are significant increases in Agreeableness in the German, Czech, and Turkish samples, but these trends do not reach significance in the British and Spanish samples. The hypothesized decline in Openness to Experience is seen clearly in the Spanish sample, and is significant in the Czech and Turkish samples. In contrast, German and British samples show significantly lower levels of Openness to Experience in the

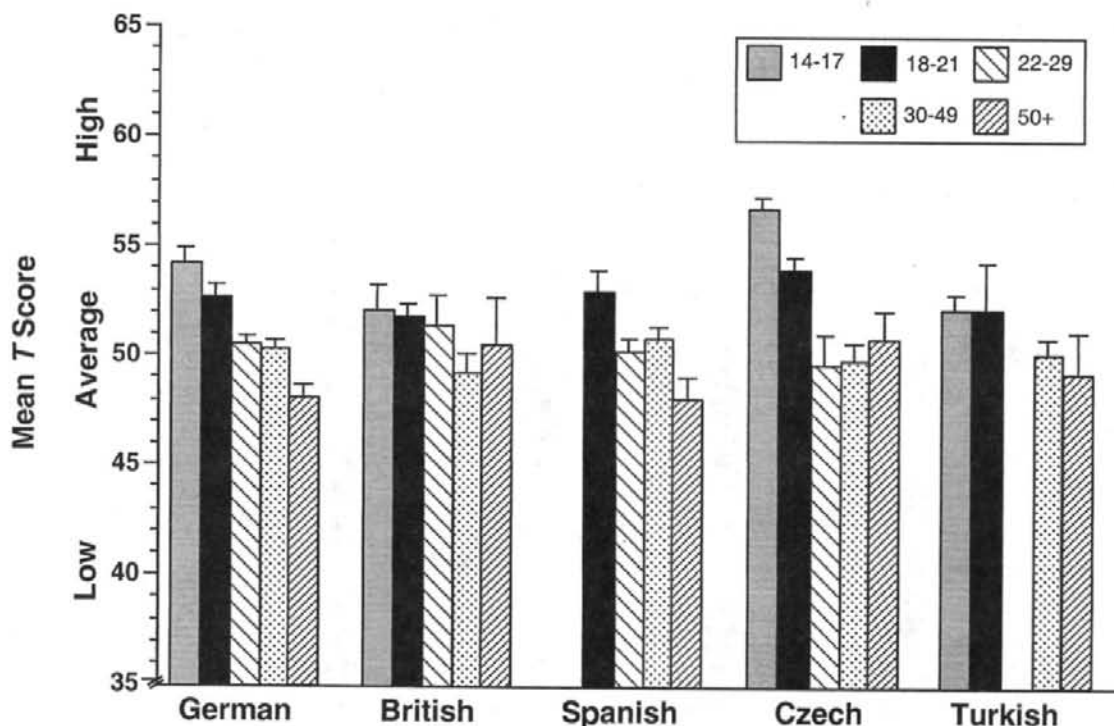


Figure 2. Mean levels of Neuroticism in five cultures. *T* scores are based on the mean and standard deviation of all respondents over age 21 within each culture. Error bars represent standard errors of the means.

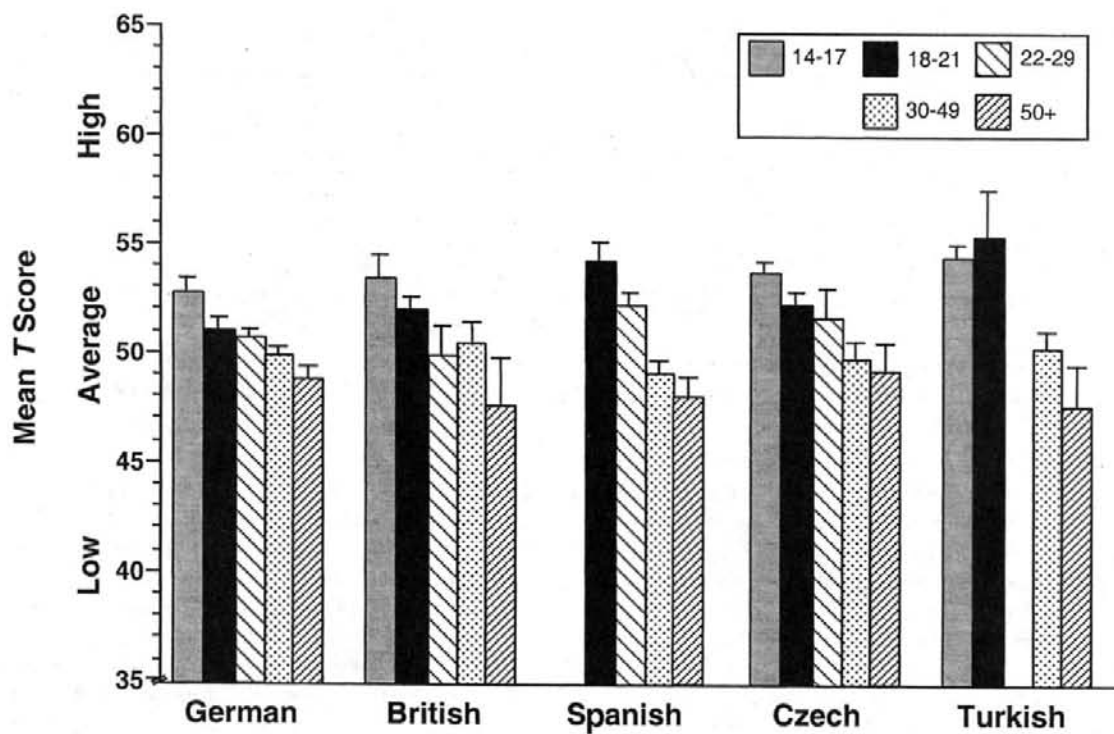


Figure 3. Mean levels of Extraversion in five cultures. *T* scores are based on the mean and standard deviation of all respondents over age 21 within each culture. Error bars represent standard errors of the means.

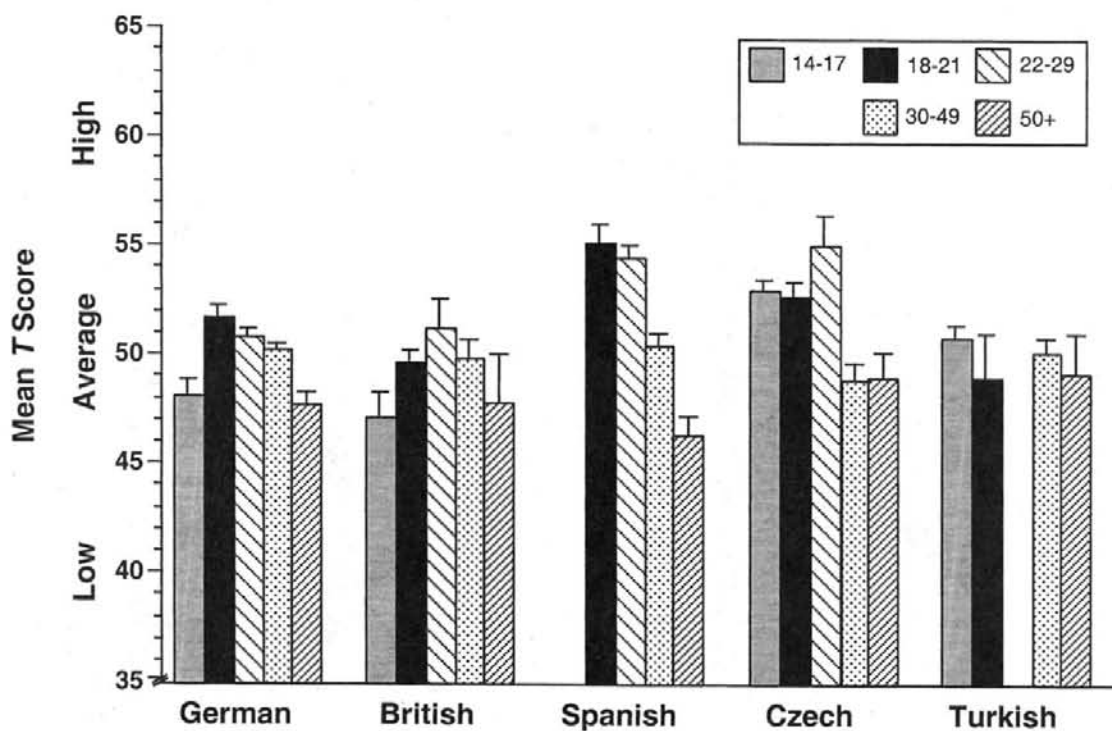


Figure 4. Mean levels of Openness to Experience in five cultures. *T* scores are based on the mean and standard deviation of all respondents over age 21 within each culture. Error bars represent standard errors of the means.

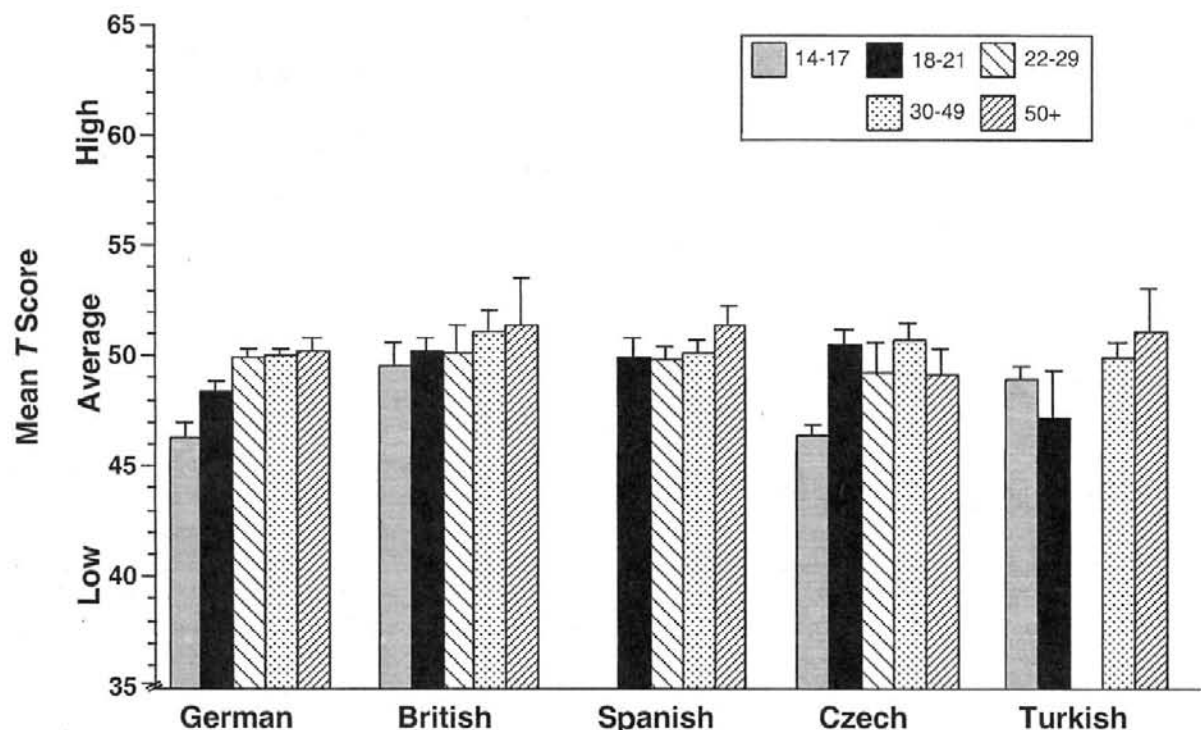


Figure 5. Mean levels of Agreeableness in five cultures. *T* scores are based on the mean and standard deviation of all respondents over age 21 within each culture. Age groups do not differ significantly in the British and Spanish samples. Error bars represent standard errors of the means.

youngest group than in the group of 18- to 21-year-olds. (The same pattern was seen when mean peer ratings were examined in the German sample.) It is not clear whether this reflects a true developmental trend, a sampling bias, or some culture-specific phenomenon.

Although the pattern of results across these samples conforms very closely to hypotheses, it is important to recall that most of the effects are quite small in magnitude. Across cultures, the median correlations of age with Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness scales are $-.17$, $-.21$, $-.08$, $.09$, and $.23$, respectively. Thus, previous reviews of the literature that concluded that mean levels of personality traits are generally stable in adulthood (McCrae & Costa, 1990) are only modestly qualified by the present findings.

To date, most information on adult age differences in personality has been based on analyses of self-reports. Comparison of peer ratings of college-age men (Costa, McCrae, & Dombroski, 1989) with older adult men (see Costa & McCrae, 1989) on the original NEO Personality Inventory showed significant effects in the expected direction for all five domains, which were substantial in magnitude (greater than one-half standard deviation) for Neuroticism and Conscientiousness. However, in the German sample examined here, mean peer ratings showed significant correlations with age only for Neuroticism ($-.05$), Agreeableness ($.06$), and Conscientiousness ($.21$). Research using the full NEO-PI-R in other cultures would be helpful in clarifying the nature and extent of age differences and changes in observer-rated personality traits.

The NEO-FFI used in the present study does not assess specific facets of the five factors. Earlier research, however, has shown that

individual facet scales of the NEO-PI-R show distinctive age trends across cultures. For example, the Excitement-Seeking facet of Extraversion declined markedly in nine out of nine cultures, whereas the Assertiveness facet showed significant (and small) declines in only four of them. Additional analyses on the specific variance in facet scales (net of the five factors) also showed generalizable, albeit very small, effects (Costa et al., in press).

Intrinsic Maturation and Adult Temperament

The data in Figures 2-6 are largely consistent with earlier observations that the same pattern of age differences in personality traits can be seen across different cultures with different recent histories. There appear to be three possible explanations for this phenomenon. The first is that age differences are cohort effects, reflecting the influence of historical forces common to all these cultures, such as the rise of the mass media or the near-universal improvement in health care. Although this possibility cannot be excluded, it would seem to be a remarkable coincidence that common historical forces affect all five factors, whereas historical experiences unique to each culture affect none of the factors enough to reverse the usual pattern.

One way to test this hypothesis would be to assess the effect within cultures of variables that might plausibly account for common cohort differences. For example, higher levels of Openness to Experience in younger cohorts might be due to increasing levels of formal education over the course of this century in most cultures. If so, covarying years of education would reduce or eliminate age differences in Openness to Experience. We tested that hypothesis

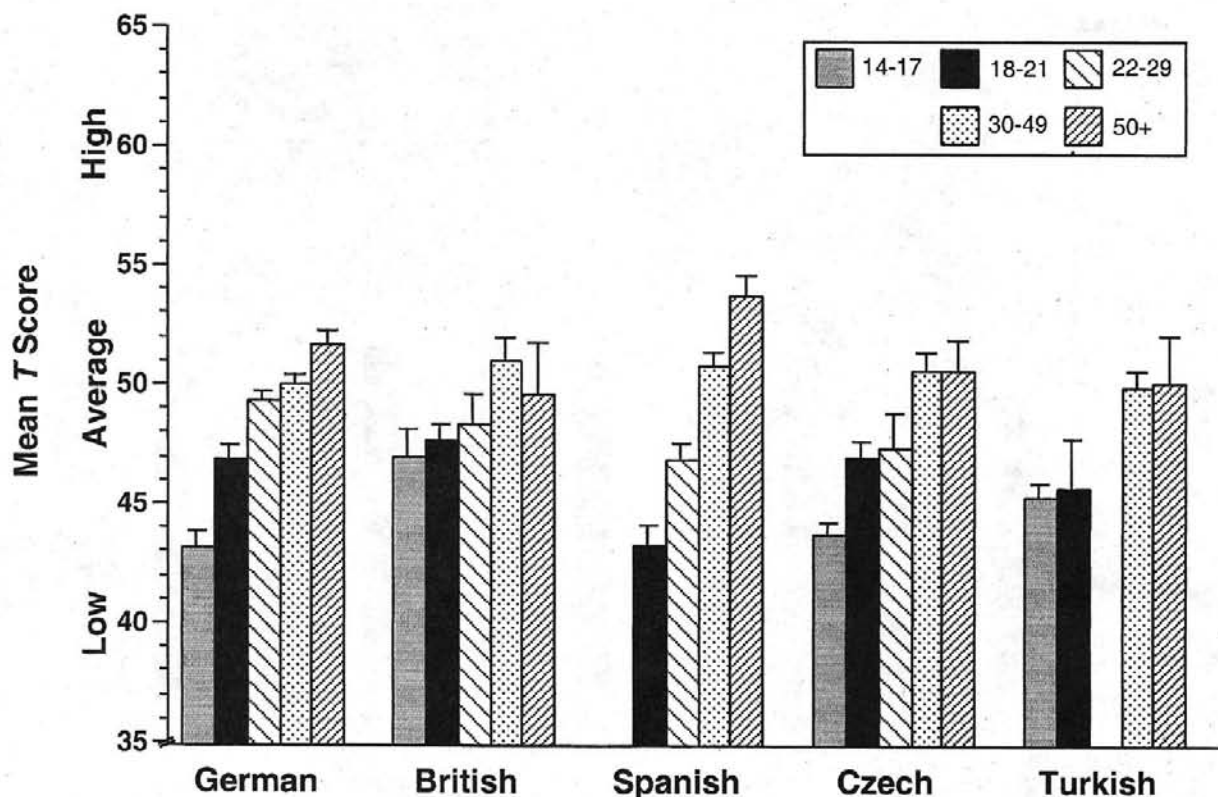


Figure 6. Mean levels of Conscientiousness in five cultures. *T* scores are based on the mean and standard deviation of all respondents over age 21 within each culture. Error bars represent standard errors of the means.

in the Spanish, German, and Turkish samples, in which data on education were available, but found that significant age differences in Openness to Experience remained.

A second possibility is that societies everywhere (or perhaps modern industrial societies everywhere) spontaneously develop parallel institutions that encourage the same trends in personality development. Adult responsibilities may make adults more responsible; caring for children may make them more caring. This possibility cannot be easily dismissed, but it is not yet proven. Even if there is an association between age-role demands and personality traits, it is possible that the causal order is reversed, and that social norms have been crafted to accommodate intrinsic maturational trends in personality. This is quite clear in the case of laws defining a minimum age for driving, voting, and drinking.

A third possibility is that there are natural progressions of personality development that occur without regard to cultural and historical context. Just as children learn to talk, count, and reason in a fixed order and time course, so too may adults become more agreeable and less extraverted as a natural consequence of aging. This notion of intrinsic maturation is consistent with the other lines of evidence—heritability, stability, and cross-cultural universality—that point to the interpretation of traits as endogenous basic tendencies.

It is also supported more directly by behavior-genetic and comparative evidence on age changes in personality. Changes in personality traits between adolescence and young adulthood have been shown to be modestly to moderately heritable (McGue et al.,

1993), and developmental trends in chimpanzees (King, Landau, & Guggenheim, 1998) and rhesus monkeys (Suomi, Novak, & Well, 1996) have shown some intriguing parallels to adult human development.

Whether age grading in the social structure shapes personality development or vice-versa—or whether both processes are at work—cannot be determined from available data. Future research might test these alternative hypotheses in third-world nations where adult responsibilities are assumed at an earlier age or among people with different relevant life experiences, such as parenting. But viewing personality as temperament at least has the virtue of making intrinsic maturation a plausible hypothesis that merits testing.

Linking Child Temperament and Adult Personality

The intent of the whole preceding argument was to demonstrate that if by temperament we mean biologically based psychological tendencies with intrinsic paths of development, then standard personality inventories assess temperament, and traits such as aesthetic sensitivity, achievement striving, and modesty are as much temperaments as are activity level and behavioral inhibition. From this perspective it is perhaps not surprising that when Angleitner and Ostendorf (1994) factored adult temperament measures (A. H. Buss & Plomin, 1975; Strelau, Angleitner, Bantelmann, & Ruch, 1990) along with other markers they found the familiar structure of the five-factor model.

But if the individual differences identified by temperament researchers and personality trait psychologists are much the same, the goals and methods of these two research traditions are not. Researchers within the temperament tradition often emphasize basic processes and mechanisms. Ahadi and Rothbart (1994), for example, have examined psychological systems such as Approach and Effortful Control, and Strelau and colleagues (Strelau et al., 1990) have developed a set of constructs based on hypothesized Pavlovian properties of the central nervous system. In contrast, trait psychologists more often focus on outcomes and other correlates of traits. For example, Barrick and Mount (1991) showed that Conscientiousness is associated with superior job performance. By identifying personality traits with temperaments, researchers may begin to integrate these different emphases on causes and effects and come to a better understanding of both the origins and the expressions of basic tendencies (Costa & McCrae, in press).

The Structure and Stability of Individual Differences

It cannot be assumed that the adult structure of temperament will appear in analyses of temperament variables in children, but there is evidence that something similar to the five factors can be found in adult ratings of school children (Digman & Shmelyov, 1996; Kohnstamm, Halverson, Mervielde, & Havill, 1998) and in self-reports from children as young as 5 years old (Measelle & John, 1997). Ahadi and Rothbart (1994) have offered conceptual analyses that link child temperament constructs to adult personality factors: Approach to Extraversion, Anxiety to Neuroticism, and Effortful Control to Conscientiousness and Agreeableness. Classic efforts at understanding infant temperament (Thomas, Chess, & Birch, 1968) were not informed by the five-factor model; if investigators looked for these factors, they might find them even in neonates, just as they have been found in nonhuman animals (King & Figueredo, 1997).

Even if identical factors were found in infants and adults, it would not imply that infant temperament is a good predictor of adult personality. Reviews of the longitudinal literature have reported that temperament variables in fact show limited stability across relatively short intervals, especially among infants (e.g., Lemery, Goldsmith, Klinnert, & Mrazek, 1999), and very modest prediction of adult traits (Wachs, 1994). Block (1993), for example, examined retest correlations for ego undercontrol and ego resiliency at age 3 and age 23 in boys and girls; only one of these four correlations reached significance (although all were positive). In a recent review of the longitudinal attachment literature, Fraley (1998) reported an average correlation of .19 between attachment at age 1 and age 19. Kagan and Zentner (1996) found only modest associations between characteristics of early childhood and adult psychopathology.

Even modest associations can be meaningful if the outcomes are socially significant. Caspi and colleagues (Caspi, Elder, & Herbener, 1990) have shown that childhood personality traits (including shyness and ill-temperedness) can predict important life outcomes such as delayed marriage and downward mobility. Undercontrol at age 3 predicts health-risk behaviors in young adults through the mediation of personality traits in adolescence (Caspi et al., 1997).

With shorter intervals and older children, stronger associations are found. For example, ego control showed a retest correlation of

.70 between age 3 and age 4, and .67 between age 14 and age 23 (Block, 1993). Siegler and colleagues (Siegler et al., 1990) estimated that half of the variance in personality dimensions is stable from late adolescence to middle adulthood, and Helson and Moane (1987) reported greater stability between age 27 and age 43 (a 16-year interval) than between age 21 and age 27 (a 6-year interval). When adults initially over age 30 are studied, uncorrected retest coefficients near .70 are not uncommon over 30-year periods (Costa & McCrae, 1992b).

One very general principle of life span personality development thus appears to be that the stability of individual differences over a fixed time interval increases steadily from infancy up to at least age 30. Environmentalists might assume that this phenomenon is attributable to the accumulation of life experiences: Any single new experience should affect more change when it occurs in the context of the limited experience of early life than when it competes with a lifetime of other experiences.

In contrast, FFT suggests another answer: Endogenous dispositions develop over time in ways that redistribute rank orderings. The functioning of genes, after all, is not fixed at birth; they switch on and off across the life span and contribute to individual patterns of aging. The brain itself continues to grow and develop until at least the mid-20s (Pujol, Vendrell, Junqué, Martí-Vilalta, & Capdevila, 1993), so it is hardly surprising that personality traits would also change in this period.

Developmental Trends for Five Factors

At the aggregate level, it is possible to describe general developmental trends for the five factors (and the specific traits that define them; see McCrae et al., 1999). From age 18 to age 30 there are declines in Neuroticism, Extraversion, and Openness to Experience, and increases in Agreeableness and Conscientiousness; after age 30 the same trends are found, although the rate of change seems to decrease.

In this article we presented some of the first data tracing the five factors backward from age 18, with German, British, Czech, and Turkish samples. For the most part, high-school-age boys and girls appeared to continue the same trends: They were even higher in Neuroticism and Extraversion and lower in Agreeableness and Conscientiousness than were college-age students. No clear trend could be discerned for Openness to Experience, as lower instead of higher scores were found in the German and British samples.

The present data do support the use of instruments like the NEO-FFI in younger adolescents, and it would be a relatively simple matter to conduct cross-sectional studies on representative samples of this age group. Research with even younger samples is possible, but would require new instruments. Measelle and John (1997), for example, used a puppet interview to assess personality in young children and reported increases in Conscientiousness between ages 5 and 7. Calibrating puppet interviews and NEO-FFIs would be difficult, so it is likely that developmental trends will have to be pieced together from studies of overlapping segments of childhood.

What could account for these developmental trends? Evolutionary arguments might be offered. High levels of Extraversion and Openness to Experience might be useful in finding a mate, whereas higher Agreeableness and Conscientiousness might be more important for raising a family. Comparative studies of personality

development in other primates (King et al., 1998) with different patterns of mating and child rearing might be used to test such evolutionary hypotheses.

The Development of Characteristic Adaptations

Finally, it is worth recalling that FFT postulates developments on two separate tracks: Basic tendencies follow a pattern of intrinsic maturation, whereas characteristic adaptations respond to the opportunities and incentives of the social environment. To the extent that the theory is correct, psychologists, educators, and parents will have relatively little impact on the long-term development of personality traits, but they can have an influence on characteristic adaptations (cf. Harkness & Lilienfeld, 1997). Traits can be channeled even if they cannot be changed. What kinds of habits, skills, beliefs, and social networks are optimal for shy or ill-tempered children? These are likely to be the most productive questions for those concerned about shaping human development.

References

- Agronick, G. S., & Duncan, L. E. (1998). Personality and social change: Individual differences, life path, and importance attributed to the women's movement. *Journal of Personality and Social Psychology, 74*, 1545-1555.
- Ahadi, S. A., & Rothbart, M. K. (1994). Temperament, development, and the Big Five. In C. F. Halverson, Jr., G. A. Kohnstamm, & R. P. Martin (Eds.), *The developing structure of temperament and personality from infancy to adulthood* (pp. 189-207). Hillsdale, NJ: Erlbaum.
- Ahadi, S. A., Rothbart, M. K., & Ye, R. (1993). Children's temperament in the US and China: Similarities and differences. *European Journal of Personality, 7*, 359-377.
- Angleitner, A., & Ostendorf, F. (1994). Temperament and the Big Five factors of personality. In C. F. Halverson, G. A. Kohnstamm, & R. P. Martin (Eds.), *The developing structure of temperament and personality from infancy to adulthood* (pp. 69-90). Hillsdale, NJ: Erlbaum.
- Asendorpf, J. B., & Wilpers, S. (1998). Personality effects on social relationships. *Journal of Personality and Social Psychology, 74*, 1531-1544.
- Barrick, M. R., & Mount, M. K. (1991). The Big Five personality dimensions and job performance: A meta-analysis. *Personnel Psychology, 44*, 1-26.
- Begley, S. (1998, September 7). The parent trap. *Newsweek*, 52-59.
- Benet-Martínez, V., & Waller, N. G. (1997). Further evidence for the cross-cultural generality of the Big Seven Factor model: Indigenous and imported Spanish personality constructs. *Journal of Personality, 65*, 567-598.
- Block, J. (1981). Some enduring and consequential structures of personality. In A. I. Rabin, J. Aronoff, A. M. Barclay, & R. A. Zucker (Eds.), *Further explorations in personality* (pp. 27-43). New York: Wiley-Interscience.
- Block, J. (1993). Studying personality the long way. In D. C. Funder, R. D. Parke, C. Tomlinson-Keasey, & K. Widaman (Eds.), *Studying lives through time: Personality and development* (pp. 9-41). Washington, DC: American Psychological Association.
- Bremner, J. D. (1998). Neuroimaging of posttraumatic stress disorder. *Psychiatric Annals, 28*, 445-450.
- Buss, A. H. (1997). Evolutionary perspectives on personality traits. In R. Hogan, J. Johnson, & S. R. Briggs (Eds.), *Handbook of personality psychology* (pp. 345-366). San Diego, CA: Academic Press.
- Buss, A. H., & Plomin, R. (1975). *A temperament theory of personality development*. New York: Wiley.
- Buss, D. M. (1991). Evolutionary personality psychology. *Annual Review of Psychology, 42*, 459-491.
- Buss, D. M., & Greiling, H. (1999). Adaptive individual differences. *Journal of Personality, 67*, 209-243.
- Caspi, A., Begg, D., Dickson, N., Harrington, H. L., Langley, J., Moffitt, T. E., & Silva, P. A. (1997). Personality differences predict health-risk behaviors in young adulthood: Evidence from a longitudinal study. *Journal of Personality and Social Psychology, 73*, 1052-1063.
- Caspi, A., Elder, G. H., Jr., & Herbener, E. S. (1990). Childhood personality and the prediction of life-course patterns. In L. N. Robins & M. Rutter (Eds.), *Straight and devious pathways from childhood to adulthood* (pp. 13-35). New York: Cambridge University Press.
- Cheung, F. M., Leung, K., Fan, R. M., Song, W. Z., Zhang, J. X., & Zhang, J. P. (1996). Development of the Chinese Personality Assessment Inventory. *Journal of Cross-Cultural Psychology, 27*, 181-199.
- Church, A. T., Katigbak, M. S., & Reyes, J. A. S. (1998). Further exploration of Filipino personality structure using the lexical approach: Do the Big-Five or Big-Seven dimensions emerge? *European Journal of Personality, 12*, 249-270.
- Cloninger, C. R., Przybeck, T. R., Svrakic, D. M., & Wetzel, R. D. (1994). *The Temperament and Character Inventory (TCI): A guide to its development and use*. St. Louis, MO: Washington University, Center for Psychobiology of Personality.
- Costa, P. T., Jr., & McCrae, R. R. (1989). *The NEO-PI/NEO-FFI manual supplement*. Odessa, FL: Psychological Assessment Resources.
- Costa, P. T., Jr., & McCrae, R. R. (1992a). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual*. Odessa, FL: Psychological Assessment Resources.
- Costa, P. T., Jr., & McCrae, R. R. (1992b). Trait psychology comes of age. In T. B. Sonderegger (Ed.), *Nebraska Symposium on Motivation: Psychology and aging* (pp. 169-204). Lincoln: University of Nebraska Press.
- Costa, P. T., Jr., & McCrae, R. R. (1994). Stability and change in personality from adolescence through adulthood. In C. F. Halverson, G. A. Kohnstamm, & R. P. Martin (Eds.), *The developing structure of temperament and personality from infancy to adulthood* (pp. 139-150). Hillsdale, NJ: Erlbaum.
- Costa, P. T., Jr., & McCrae, R. R. (in press). A theoretical context for adult temperament. In T. D. Wachs & G. A. Kohnstamm (Eds.), *Temperament in context*. Hillsdale, NJ: Erlbaum.
- Costa, P. T., Jr., McCrae, R. R., & Dembroski, T. M. (1989). Agreeableness vs. antagonism: Explication of a potential risk factor for CHD. In A. Siegman & T. M. Dembroski (Eds.), *In search of coronary-prone behavior: Beyond Type A* (pp. 41-63). Hillsdale, NJ: Erlbaum.
- Costa, P. T., Jr., McCrae, R. R., Martin, T. A., Oryol, V. E., Senin, I. G., Rukavishnikov, A. A., Shimonaka, Y., Nakazato, K., Gondo, Y., Takayama, M., Allik, J., Kallasmaa, T., & Realo, A. (in press). Personality development from adolescence through adulthood: Further cross-cultural comparisons of age differences. In V. J. Molfese & D. Molfese (Eds.), *Temperament and personality development across the life span*. Hillsdale, NJ: Erlbaum.
- Costa, P. T., Jr., McCrae, R. R., Zonderman, A. B., Barbano, H. E., Lebowitz, B., & Larson, D. M. (1986). Cross-sectional studies of personality in a national sample: 2. Stability in neuroticism, extraversion, and openness. *Psychology and Aging, 1*, 144-149.
- Digman, J. M., & Shmelyov, A. G. (1996). The structure of temperament and personality in Russian children. *Journal of Personality and Social Psychology, 71*, 341-351.
- Eysenck, H. J. (1990). Genetic and environmental contributions to individual differences: The three major dimensions of personality. *Journal of Personality, 58*, 245-262.
- Eysenck, S. B. G. (1983). One approach to cross-cultural studies of personality. *Australian Journal of Psychology, 35*, 383-390.
- Finn, S. E. (1986). Stability of personality self-ratings over 30 years:

- Evidence for an age/cohort interaction. *Journal of Personality and Social Psychology*, 50, 813–818.
- Fraley, R. C. (1998). *Attachment continuity from infancy to adulthood: Meta-analysis and dynamic modeling of developmental mechanisms*. Unpublished manuscript, University of California, Davis.
- Goldberg, L. R. (1993). The structure of phenotypic personality traits. *American Psychologist*, 48, 26–34.
- Gosling, S. D. (1998). *From mice to men: What can animal research tell us about human personality?* Unpublished manuscript, University of California, Berkeley.
- Gosling, S. D., & John, O. P. (1998, May). Personality dimensions in dogs, cats, and hyenas. In S. D. Gosling & S. Suomi (Chairs), *From mice to men: Bridging the gap between personality and animal researchers*. Symposium conducted at the 10th Annual Convention of the American Psychological Society, Washington, DC.
- Gough, H. G. (1987). *California Psychological Inventory administrator's guide*. Palo Alto, CA: Consulting Psychologists Press.
- Guilford, J. S., Zimmerman, W. S., & Guilford, J. P. (1976). *The Guilford-Zimmerman Temperament Survey Handbook: Twenty-five years of research and application*. San Diego, CA: EdITS.
- Harkness, A. R., & Lilienfeld, S. O. (1997). Individual differences science for treatment planning: Personality traits. *Psychological Assessment*, 9, 349–360.
- Harris, J. R. (1998). *The nurture assumption: Why children turn out the way they do*. New York: Free Press.
- Helson, R., & Moane, G. (1987). Personality change in women from college to midlife. *Journal of Personality and Social Psychology*, 53, 176–186.
- Jang, K. L., McCrae, R. R., Angleitner, A., Riemann, R., & Livesley, W. J. (1998). Heritability of facet-level traits in a cross-cultural twin study: Support for a hierarchical model of personality. *Journal of Personality and Social Psychology*, 74, 1556–1565.
- Jessor, R. (1983). The stability of change: Psychosocial development from adolescence to young adulthood. In D. Magnusson & V. L. Allen (Eds.), *Human development: An interactional perspective* (pp. 321–341). New York: Academic Press.
- Juni, S. (1996). Review of the revised NEO Personality Inventory. In J. C. Conoley & J. C. Impara (Eds.), *12th Mental Measurements Yearbook* (pp. 863–868). Lincoln: University of Nebraska Press.
- Kagan, J., & Moss, H. A. (1962). *From birth to maturity*. New York: Wiley.
- Kagan, J., & Zentner, M. (1996). Early childhood predictors of adult psychopathology. *Harvard Review of Psychiatry*, 3, 341–350.
- Kagitçibaşı, Ç. (1996). *Family and human development across cultures: A view from the other side*. Hillsdale, NJ: Erlbaum.
- King, J. E., & Figueredo, A. J. (1997). The five-factor model plus dominance in chimpanzee personality. *Journal of Research in Personality*, 31, 257–271.
- King, J. E., Landau, V. I., & Guggenheim, C. B. (1998, May). Age-related personality changes in chimpanzees. In S. D. Gosling & S. Suomi (Chairs), *From mice to men: Bridging the gap between personality and animal researchers*. Symposium conducted at the 10th Annual Convention of the American Psychological Society, Washington, DC.
- Kitayama, S., & Markus, H. R. (Eds.). (1994). *Emotion and culture: Empirical studies of mutual influences*. Washington, DC: American Psychological Association.
- Kluckhohn, C. (1944). Navaho witchcraft. *Papers of the Peabody Museum of American Archaeology and Ethnology* (Vol. 22, No. 3). Cambridge, MA: Harvard University.
- Kluckhohn, C., & Murray, H. A. (1953). Personality formation: The determinants. In C. Kluckhohn, H. A. Murray, & D. M. Schneider (Eds.), *Personality in nature, society, and culture* (2nd ed., pp. 53–67). New York: Knopf.
- Kohnstamm, G. A., Havlerson, C. F., Jr., Mervielde, I., & Havill, V. L. (Eds.). (1998). *Parental descriptions of child personality: Developmental antecedents of the Big Five?* Hillsdale, NJ: Erlbaum.
- Kolb, B., & Whishaw, I. Q. (1998). Brain plasticity and behavior. *Annual Review of Psychology*, 49, 43–64.
- Labouvie-Vief, G., Diehl, M., Tarnowski, A., & Shen, J. (in press). Age differences in adult personality: Findings from the United States and China. *Journal of Gerontology: Psychological Sciences*.
- Lemery, K. S., Goldsmith, H. H., Klinnert, M. D., & Mrazek, D. A. (1999). Developmental models of infant and childhood temperament. *Developmental Psychology*, 35, 189–204.
- Loehlin, J. C. (1992). *Genes and environment in personality development*. Newbury Park, CA: Sage.
- Martin, T. A., Draguns, J. G., Oryol, V. E., Senin, I. G., Rukavishnikov, A. A., & Klotz, M. L. (1997, August). *Development of a Russian-language NEO-PI-R*. Paper presented at the 105th Annual Convention of the American Psychological Association, Chicago, IL.
- McAdams, D. P. (1996). Personality, modernity, and the storied self: A contemporary framework for studying persons. *Psychological Inquiry*, 7, 295–321.
- McCrae, R. R., & Costa, P. T., Jr. (1988). Recalled parent-child relations and adult personality. *Journal of Personality*, 56, 417–434.
- McCrae, R. R., & Costa, P. T., Jr. (1990). *Personality in adulthood*. New York: Guilford Press.
- McCrae, R. R., & Costa, P. T., Jr. (1994). The paradox of parental influence: Understanding retrospective studies of parent-child relations and adult personality. In C. Perris, W. A. Arrindell, & M. Eisemann (Eds.), *Parenting and psychopathology* (pp. 107–125). New York: Wiley.
- McCrae, R. R., & Costa, P. T., Jr. (1996). Toward a new generation of personality theories: Theoretical contexts for the five-factor model. In J. S. Wiggins (Ed.), *The five-factor model of personality: Theoretical perspectives* (pp. 51–87). New York: Guilford Press.
- McCrae, R. R., & Costa, P. T., Jr. (1997). Personality trait structure as a human universal. *American Psychologist*, 52, 509–516.
- McCrae, R. R., & Costa, P. T., Jr. (1999). A five-factor theory of personality. In L. Pervin & O. P. John (Eds.), *Handbook of personality* (2nd ed., pp. 139–153). New York: Guilford Press.
- McCrae, R. R., Costa, P. T., Jr., del Pilar, G. H., Rolland, J. P., & Parker, W. D. (1998). Cross-cultural assessment of the five-factor model: The Revised NEO Personality Inventory. *Journal of Cross-Cultural Psychology*, 29, 171–188.
- McCrae, R. R., Costa, P. T., Jr., Lima, M. P., Simões, A., Ostendorf, F., Angleitner, A., Marušić, I., Bratko, D., Caprara, G. V., Barbaranelli, C., Chae, J. H., & Piedmont, R. L. (1999). Age differences in personality across the adult life span: Parallels in five cultures. *Developmental Psychology*, 35, 466–477.
- McCrae, R. R., Yik, M. S. M., Trapnell, P. D., Bond, M. H., & Paulhus, D. L. (1998). Interpreting personality profiles across cultures: Bilingual, acculturation, and peer rating studies of Chinese undergraduates. *Journal of Personality and Social Psychology*, 74, 1041–1055.
- McGue, M., Bacon, S., & Lykken, D. T. (1993). Personality stability and change in early adulthood: A behavioral genetic analysis. *Developmental Psychology*, 29, 96–109.
- Measelle, J., & John, O. P. (1997, May). *Young children's self-perceptions on the Big Five: Consistency, stability, and school adaptation from age 5 to age 7*. Paper presented at the Biennial Meeting of the Society for Research in Child Development, Washington, DC.
- Morris, W. (1976). *The American heritage dictionary of the English language*. Boston: Houghton Mifflin.
- Nelson, C. A. (1999). Neural plasticity and human development. *Current Directions in Psychological Science*, 8, 42–45.
- Norman, W. T., & Goldberg, L. R. (1966). Raters, ratees, and randomness in personality structure. *Journal of Personality and Social Psychology*, 4, 681–691.

- Parker, W. D., & Stumpf, H. (1998). A validation of the five-factor model of personality in academically-talented youth across observers and instruments. *Personality and Individual Differences*, *25*, 1005-1025.
- Passini, F. T., & Norman, W. T. (1966). A universal conception of personality structure? *Journal of Personality and Social Psychology*, *4*, 44-49.
- Paunonen, S. V., Jackson, D. N., Trzebinski, J., & Forsterling, F. (1992). Personality structure across cultures: A multimethod evaluation. *Journal of Personality and Social Psychology*, *62*, 447-456.
- Plomin, R., Corley, R., Caspi, A., Fulker, D. W., & DeFries, J. (1998). Adoption results for self-reported personality: Evidence for nonadditive genetic effects? *Journal of Personality and Social Psychology*, *75*, 211-218.
- Plomin, R., & Daniels, D. (1987). Why are children in the same family so different from one another? *Behavioral and Brain Sciences*, *10*, 1-16.
- Pujol, J., Vendrell, P., Junqué, C., Martí-Vilalta, J. L., & Capdevila, A. (1993). When does human brain development end? Evidence of corpus callosum growth up to adulthood. *Annals of Neurology*, *34*, 71-75.
- Rapee, R. M. (1997). Potential role of childrearing practices in the development of anxiety and depression. *Clinical Psychology Review*, *17*, 47-67.
- Resnick, S. M., Gottesman, I. I., & McGue, M. (1993). Sensation seeking in opposite-sex twins: An effect of prenatal hormones? *Behavior Genetics*, *23*, 323-329.
- Riemann, R., Angleitner, A., & Strelau, J. (1997). Genetic and environmental influences on personality: A study of twins reared together using the self- and peer-report NEO-FFI scales. *Journal of Personality*, *65*, 449-475.
- Siegler, I. C., & Costa, P. T., Jr. (1999, August). *Personality continuity and change in midlife men and women*. Symposium presented at the 107th Annual Convention of the American Psychological Association, Boston, MA.
- Siegler, I. C., George, L. K., & Okun, M. A. (1979). Cross-sequential analysis of adult personality. *Developmental Psychology*, *15*, 350-351.
- Siegler, I. C., Zonderman, A. B., Barefoot, J. C., Williams, R. B., Jr., Costa, P. T., Jr., & McCrae, R. R. (1990). Predicting personality in adulthood from college MMPI scores: Implications for follow-up studies in psychosomatic medicine. *Psychosomatic Medicine*, *52*, 644-652.
- Singer, M. (1961). A survey of culture and personality theory and research. In B. Kaplan (Ed.), *Studying personality cross-culturally* (pp. 9-90). Evanston, IL: Row, Peterson.
- Strelau, J., Angleitner, A., Bantelmann, J., & Ruch, W. (1990). The Strelau Temperament Inventory—Revised (STI-R): Theoretical considerations and scale development. *European Journal of Personality*, *4*, 209-235.
- Stumpf, H. (1993). The factor structure of the Personality Research Form: A cross-national evaluation. *Journal of Personality*, *61*, 27-48.
- Suomi, S. J., Novak, M. A., & Well, A. (1996). Aging in rhesus monkeys: Different windows on behavioral continuity and change. *Developmental Psychology*, *32*, 1116-1128.
- Tellegen, A. (1988). The analysis of consistency in personality assessment. *Journal of Personality*, *56*, 621-663.
- Thomas, A., Chess, S., & Birch, H. G. (1968). *Temperament and behavior disorders in children*. New York: New York University Press.
- Tooby, J., & Cosmides, L. (1990). On the universality of human nature and the uniqueness of the individual: The role of genetics and adaptation. *Journal of Personality*, *58*, 17-68.
- Wachs, T. D. (1994). Fit, context, and the transition between temperament and personality. In C. F. Halverson, Jr., G. A. Kohnstamm, & R. P. Martin (Eds.), *The developing structure of temperament and personality from infancy to adulthood* (pp. 209-220). Hillsdale, NJ: Erlbaum.
- Xiu, S., Wu, Z., Wu, Z., & Shui, C. (1996). Study of age differences on personality features of adults. *Psychological Science*, *19*, 1-5. [in Chinese]
- Yang, J., McCrae, R. R., & Costa, P. T., Jr. (1998). Adult age differences in personality traits in the United States and the People's Republic of China. *Journal of Gerontology: Psychological Sciences*, *53B*, P375-P383.

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